AN AURAL STUDY SYSTEM DESIGNED FOR THE VISUALLY HANDICAPPED

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The Aural Study System designed and built at the American Printing House for the Blind (APH) did not just evolve, but rather was the product of several years of systematic study into the processes and procedures involved in aural learning by the blind. The impetus for such research was the oft noted slow reading rates for those who read by braille. Information on these has been concisely summarized by Nolan and Kederis (1969) where it is abundantly apparent that braille, at best, is a poor means of communication.

At the beginning of the sixth decade of this century, personnel in APH's Department of Educational Research became concerned over the slow reading rates of the blind and became interested in the academic utilization of listening as a possible means of alleviating the problem. Search of the literature revealed that, at that time, only one study (Lowenfeld, 1945) was reported where learning through reading and listening had been compared for a blind population. Results of this study showed listening to be the superior mode of communication under a number of circumstances and the faster mode under all circumstances.

The first listening study conducted by APH was done in collaboration with the University of Louisville (Bixler, Foulke, Amster & Nolan, 1961) and concerned comprehension of rapid speech by the blind. Results indicated that, within limits, this approach would be feasible. However, at this point it became evident that, because of the dearth of information concerning aural learning by the blind, the scope of the research effort needed to be extended beyond mere use of compressed or speeded speech.

Shortly thereafter, APH conducted a pilot study (Nolan, 1963) of the relative learning achieved through reading and listening by

Selected Papers, AEVH 51st Biennial Conference
June 1972, Miami Beach, Florida

In summary let me say listening is just one method visually handicapped students have of gaining information. Our major concern should be how that information is used in the learning situation. If you are asked, "Is listening the answer?" consider how listening can be used to develop independent study skills and answer in the affirmative.

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blind children. Results of this study revealed "no significant differences between listening and reading, amounts of practice or their interaction. ... listening time was about one-third that for reading [p. 315]." These results were a valuable addition to those reported by Lowenfeld (1945) as they were obtained from subjects reading the now commonly used braille grade two whereas Lowenfeld's subjects had read the then commonly used braille grade one and braille grade one and a half. Following the encouraging results of Nolan's pilot study, APH obtained a grant from the Institute of Neurological Diseases and Blindness of the National Institute of Health to study in greater depth reading and listening in learning by the blind. The studies conducted in this series were reported by Nolan (1966, 1968). They provide uncontestable evidence that listening is the superior mode for learning a variety of subject areas, in terms of efficiency, for both elementary (grades 4-6) and high school level students regardless of whether they read by braille or large type (Morris, 1966). Another finding of interest resulting from these studies was that of reading rate for the three types of text material used; namely, literature, science, and social studies. Using materials appropriate in reading difficulty for the grade level of their users, it was found that the average reading rate for the three types of material for elementary students in grades 4-6 ranged from 50 to 60 words per minute for readers of braille and from 69 to 74 words per minute for legally blind readers of large type. Braille reading high school students' reading rates ranged from 65 to 74 words per minute while their large type reading counterparts read at rates ranging from 80 to 86 words per minute. These rates were determined from passages of approximately 2100 words and are considered realistic for study type material. The figures empirically substantiate the fact that the reading deficit, in terms of time required, for users of large type is practically as severe as that for users of braille; consequently, their need for a more rapid mode of communication is practically as great.

Other information obtained through this series of studies pointed up a serious problem of incompatibility between playback equipment, recording formats, writing equipment, and the techniques employed by students when using recorded materials to study. This problem was a result of the equipment and materials having been made for recreational purposes rather than scholastic use. This, coupled with the fact that the number of students depending on recorded materials was rapidly increasing, made it quite evident that a growing need existed for complementary hardware and software geared to aural study.

Early in 1968 a grant was obtained from the U. S. Office of Education, Bureau of Education for the Handicapped, enabling APH to continue with its listening research. One of the specific aims of this project was to design and build a system for study using recorded texts that would coordinate design of playback equipment, recorded book formats, and response systems around the goals for efficient study. Also specified was that the system be evaluated through user tests. Initial specifications for the resulting Aural Study System for the visually handicapped were determined from three sources. First, findings from individual interviews with public school students in New Jersey who regularly studied from recorded textbooks (Nolan, 1966) were reviewed. Second, an analysis was made of the tasks involved in studying from recorded material (Morris & Nolan, 1970b). And third, blind college students who traditionally studied from aural material were queried as to their ideas about recorded textbook format and as to the aural study methods they had worked out for themselves. Additionally, these students were asked for suggestions concerning both materials and equipment that would provide for more efficient use (Morris & Nolan, 1970a).

Working from these specifications, the Aural Study System was designed. It included four major components. These were an especially made record player incorporating the many special features designated as desirable for study purposes, a stereophonic record made for use with the special record player, a written key for use in locating places on the record, and a written supplement containing text material more easily used in written than recorded form.

One of the primary requirements for the Aural Study System was that it provide a means for rapid place finding; this being identified as the greatest problem students have in their use of recorded materials. With this goal in mind, the Aural Study System was designed incorporating two indexing features making possible both gross and fine search. When used in conjunction with each other, they enabled a user to find any desired place on a record with only a brief search period.

The original experimental recording made for use with the system was of a unit on Latin America taken from a world history book (Stavrianos, Andrews, Blanksten, Hackett, Leppert, Murphy & Smith, 1962) for tenth through twelfth grade use. The unit was contained on two sides of a 12-inch record recorded at 8-1/3 rpm. This represented 67 pages of the ink-print edition. Narrow bands about

1/16 of an inch wide divided the experimental recording into 11 parts; six parts being on side one and five being on side two. These bands had a single groove leading through them so that the stylus would be led from the end of one part to the start of the next part without physical intervention by the user.

The record itself was cut stereophonically, meaning that within each groove there were two tracks. Unlike commercial stereophonic systems in which both tracks are played simultaneously, the Aural Study System was constructed to play the two tracks independently. Therefore, different information could be, and was, provided on the two tracks of the record. On one track, the content track, text material was recorded at the rate of 8-1/3 rpm. This material was carefully edited in accordance with the consensus of suggestions coming from the student interviews and the task analysis and included page numbers which were read at appropriate places within the text. On the second track, the index track, index information was recorded at the rate of 66-2/3 rpm--eight times faster than the content track. Index information contained on the index track of the experimental recording consisted of page numbers; however, it could have been any kind of pertinent information. The position of the page numbers on the index track coincided with their position on the content track making it possible for a user rapidly to locate a specific page on the index track, then shift to the content track, and immediately hear the content of the desired page. On both tracks a sound signal was inserted immediately to precede the page announcements. This was done to serve as an attention getter.

A written key accompanied the record showing the parts found on each side and the pages found within each part. With this information, a user seeking a particular page could locate the page on the key and immediately learn the part in which it would be found and the side of the record on which the part would be located. By also noting the range of pages found within the sought part, the user could estimate how far into the part the sought page might occur.

The player was built with a variety of special features of which the most unique were related to its indexing capability. One of these was a photoelectric sensing device mounted in the tone arm which could be used to detect the bands on the record. Whenever this photoelectric sensing device passed over a band an audible signal, or beep, was emitted. The other means of indexing combined the player's multitrack capability with its rapid scanning

capability. By engaging either the fast forward or fast reverse operations, the turntable automatically shifted to its scanning rate of 66-2/3 rpm, and, simultaneously, the index track of the record was engaged. Thus, if a user was looking for a page the key had informed him was in the fourth part of the record, he would slowly move the tone arm inward across the record counting the "beeps" as he went. At the fourth "beep" he would know he was at the start of the fourth part. Then, he would estimate how far into the part the page might occur, set the stylus down there, and engage the fast forward mechanism. At the first page announcement, he would either have found the page or know what correction was needed. If he was looking for a subsequent page he would continue using the fast forward until the page was found. If he discovered he had gone too far into the part, he would engage the fast reverse and back until the sought page was located.

The tone arm of the record player was of a new type featuring stylus pressure light enough to prevent record damage. This tone arm was one that moved horizontally across the record rather than having to be raised before being moved. In addition to the photoelectric sensing device, it contained a retractable pickup cartridge which incorporated a mechanism for positively identifying the record edge.

Other special features of the record player included a turntable pause mechanism featuring instantaneous turntable stop and start. This device enabled a user to stop, as to make a note, without having manually to back the turntable to correct for the glide that occurs on standard models when the turntable is stopped. Another feature unique to this record player was its variable speed control. With this, turntable speed could be increased halfway up to the next faster turntable speed setting or lowered all the way to the next slower turntable speed setting. As the player was built with a three speed capability (33-1/3, 16-2/3, and 8-1/3 rpm), combined use of the turntable speed control and the variable speed control would give a user control of turntable speed over a continuum ranging from 4-1/6 to 50 rpm thus enabling him to pick any desired playback speed. Being a mechanical adjustment, naturally distortion would be introduced as the playback speed varied from the rate at which the record was manufactured to play.

The record player had hand controls for all operations which included tone, volume, and off-on in addition to those already mentioned. Additionally, it had a foot control for the fast forward, fast reverse, pause, and play turntable operations. By use

of the foot control, a student's hands would be freed for other things such as note-taking or the examination of graphic material. Other features included an option of either speaker or headphone use.

From information obtained in the student interviews and the task analysis, it was apparent that certain parts of textbooks are more useful in written form than in aural form. To meet these needs a written supplement was provided in braille. However, parallel braille and large type editions are envisioned.

The written supplement accompanying the experimental record was a book containing a title page, a table of contents, and 34 sections. Each section was numbered and referred to on the record by its number (e.g., see supplement 7-9). In this case the seven represented the unit, Latin America being the seventh unit in the text, and the nine represented the ordinal position of the section within the book of supplements. Included in the 34 sections were an outline of headings, three spelling lists, nine maps, seven graphs, a chart, one table, seven sets of study questions, one set of unit activities, three sections of references, and an index. The index made it possible for a user to find the page(s) where specific items would be found. Important as this is to any student, it is a feature usually lacking from recorded textbooks because of the unwieldiness of its use in recorded form.

All components of the Aural Study System complement one another. Together, they provide a means for a visually handicapped student to obtain information in a thorough and highly efficient manner.

The original models of the four components of the Aural Study System were critiqued by a group of blind persons of professional status who were knowledgeable in the use of recorded materials. Their suggestions were compiled and reviewed by in-house committees at APH to determine what modifications should be made in the equipment and materials comprising the system.

After these modifications were incorporated into it, the next step in the evaluation of the system was to try it out, or field test it, with blind students. This was done in two initial phases. First, 36 students who were readers of braille were taught to use the system. These students ranged in grade placement from 5 through 12. Training was given during one regular class period on each day for the first three or four days of a week. On the following day a test was administered to measure the effectiveness of

the training. Results showed that the students could learn to use the components of the system quite easily. Problems in use of the player, the written supplement, and the record were documented so that further modifications could be made on subsequent models and versions. The second phase of the field test occurred approximately two months after the first. It involved the 24 high school level students who had participated in the first phase. These students were given one day of review and then spent three class periods (one per day) performing study type tasks using the system. Only high school level students were included in this phase of the field evaluation as the text material was not appropriate for use with students at lower levels. Following the training period, these students were tested on their ability to use the system to perform study tasks. Results demonstrated that these students could use the Aural Study System to perform the required tasks. These tasks included locating information for and writing out short form answers to specific study questions, copying quotations verbatim, outlining, and summarizing. Although the quality of the written responses varied, no particular difficulties were encountered in use of the various parts of the Aural Study System or in its use as an integrated system.

The third phase of the field test will be conducted during the 1972-73 school year. If students can use the recorded version as well as, or more effectively than, the written, advantages to its use would include cost, required storage area, and the fact that one version could be used by all visually handicapped persons rather than separate braille and large type editions being required.

At the time work commenced on the Aural Study System it was decided to develop it as a disc system in the belief that much of the information acquired from development of a disc system would be applicable to tape systems as well. Such thinking was justified as many of the new features appearing on tape systems for use by the visually handicapped, open reel and cassette, are those that were identified as desirable through the Aural Study System project.

One of the primary goals of the Aural Study System project was to provide a manual for use by the visually handicapped containing information on how to study from recorded materials. Additionally, this manual was to provide recording information for these students and their personal readers that could be used in making their own nonprofessionally recorded tapes better suited to meet

their needs. Such information would include suggestions on how to incorporate indexing information on the tape, how to handle headings, graphic material, picture captions, study questions, references, footnotes, quotations, new words, proper nouns, etc. This manual should become available during the upcoming school year.

In summary, it is abundantly clear that visually handicapped students can learn and do learn through their aural channels far more efficiently than through their tactual channels or their impaired visual channels. Consequently, it behooves us, their educators, to acknowledge this simple fact and apply our efforts accordingly.

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